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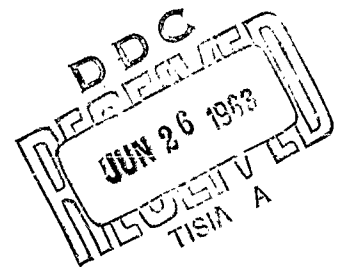
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Quarterly Progress Report No. 13

Period: March 1, 1963 - May 31, 1963

RESEARCH AND DEVELOPMENT STUDY OF  
STRESS-STRAIN CHARACTERISTICS OF SHELLS AND HIGH EXPLOSIVES

407 253



Submitted to Picatinny Arsenal Under Contract  
DA-11-022-501-ORD-2917 OMS Code 5210.12.13200

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### Work Accomplished Before the Start of Current Report Period

Work accomplished before the start of the current report period is given in the 22 Technical Reports issued since the work was begun. These 22 reports along with previously reported investigations [1], [2], [3], [4], [5] represent an integrated approach to a study of stress-strain characteristics of shells and high explosives. The over-all problem is one of considerable complexity and substantial progress has been made and important new analytical and experimental tools are now available to the ordnance engineer.

A complete experimental and theoretical elastic analysis has been made of the flat base shell and a procedure for programing the analysis on a digital computer has been provided. This work is contained in TR 1-3, TR 1-5, TN 1-3, TN 1-4, TR 1-13, TR 1-17, and TR 1-18. The engineer, therefore, now has techniques for thorough analysis of his designs and with the digital computer procedure a means of analyzing his designs in a matter of minutes. With these new tools he should be able to develop end items which will be less costly to produce and which perform their intended functions more efficiently.

Yield parameters which take into account the plastic behavior in the vicinity of the rotating band have been defined. Experimental techniques for determining the parameters have been developed. This work is contained in TR 1-3, TR 1-17, and TR 1-20.

Excellent progress has also been made on two remaining problems, namely: the behavior of filler materials, the interaction between filler and shell.

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Work Accomplished During the Current Report Period

Work was begun on the analysis of shells of revolution having generally varying cross-sectional moments of inertia. A finite difference approximation has been obtained for a shell whose generating surface is symmetrical about the generator of a right circular cylindrical surface closed by a plane normal to the cylinder's surface. Algorithms to be used in connection with the finite difference formulation are under investigation.

The finite difference approximation may, for example, be used to find stresses, strains, and deflections in a shell having any number of bays, each having different surface loadings.

Work was begun on the analysis of a conical section having a linearly varying cross section. A literature search was begun and will be included in a Technical Report.

Objectives During the Next Report Period

Work will be continued on the analysis of shells of revolution having a generally varying cross-sectional moment of inertia.

Work will be continued on the analysis of a conical section having linearly varying cross section.

Objectives During the Current Report Period

To begin the analysis of shells of revolution having a generally varying cross-sectional moment of inertia.

To begin the analysis of a conical section having a linearly varying cross section.

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References

- [1] R. C. Geldmacher, Neil Little, and T. M. Roach, Jr.,  
"A Study of Shell Stresses", Picatinny Arsenal MR-51,  
January, 1954.
- [2] R. C. Geldmacher and T. M. Roach, Jr., "A Study of  
Shell Stresses", Picatinny Arsenal MR-51(Addendum No.1),  
September, 1954.
- [3] R. C. Geldmacher, Neil Little, and T. M. Roach, Jr.,  
"Review of Shell Stress Relationships", Picatinny Arsenal  
Research Memorandum No. 9, April, 1955.
- [4] R. C. Geldmacher and T. M. Roach, Jr., "Initial Investi-  
gation of Firing Stresses in T50E2 Shell", Picatinny  
Arsenal TR 2264, January, 1956.
- [5] R. C. Geldmacher, E. G. Trabant, T. M. Roach, Jr., and  
D. M. Sen, "A Study of the Deformation of the 75 MM T50  
E2 Shell in the Region of the Rotating Band", Picatinny  
Arsenal Report No. ORDBB-TK-330, October, 1958.

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